SOLAR OBSERVATIONS

SOLAR-RADIATION MEASUREMENTS DURING DECEMBER, 1932

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For a description of instruments employed and their exposures, the reader is referred to the January, 1932, REVIEW, page 26.

Table 1 shows that solar-radiation intensities averaged slightly above normal values for December at Washington; slightly below at Lincoln and considerably below at Madison.

Table 2 shows an excess in the total solar radiation received on a horizontal surface at all stations with the exception of Madison, Twin Falls, Idaho, and Miami.

Table 3 shows low turbidity values for the three days on which these measurements were made. No observations of this character were made during the fore part of the month due to the assembling of a new equatorial mounting.

Polarization measurements obtained on eight days at Washington give a mean of 55 per cent with a maximum of 63 per cent occurring on both the 20th and 22d. These are average December values for Washington. No measurements were obtained at Madison due to the presence of snow and ice.

The outstanding feature for the year is the unprecedented large increase in radiation received on a horizontal surface from the sun at various places throughout the country. Without doubt the business depression was an important indirect factor in this increase. It will be noted that the large cities of New York and Chicago show the greatest plus departures. Dust and smoke records from these two cities and also from Pittsburgh show a marked diminution for the year, which would be expected, as the amount of manufacturing had fallen off greatly during this period. Many factories as well as household heating plants are now run on a more efficient and economic basis, which further tends to lessened contamination of the atmosphere. The three stations reporting a diminution in radiation receipt for the year, Twin Falls, La Jolla, and Miami, are all located in nonmanufacturing sections.

It is interesting to note that recent reports issued by the United States Public Health Service show better health conditions throughout the country, coincident at any rate with an increase in the amount of ultra-violet radiation received.

TABLE 1.—*Solar-radiation intensities during December, 1932*

[Gram-calories per minute per square centimeter of normal surface]

Washington, D. C.

Date	Sun's zenith distance: 8a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass: A. M.					P. M.				Local mean solar time
	e.	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Dec. 1	2.49	0.75	0.91	1.10	1.20			1.09	0.93	0.73	3.15
Dec. 3	4.57	.64	.79	.97	1.17	1.40					6.27
Dec. 5	3.00	1.04	1.14	1.28	1.47			1.18	1.00	.72	2.87
Dec. 6	4.37	.84	.95	1.14	1.33			.99	.82		4.37
Dec. 7	3.45			1.02							5.79
Dec. 8	2.74	.80	.96	1.05							2.87
Dec. 9	3.30		.69	.97							3.00
Dec. 20	2.26	.76	.91	1.05	1.28						2.49
Dec. 22	4.75	.93	1.05	1.18	1.40						3.63
Dec. 29	4.37	.80	.91	1.05	1.17						4.75
Means		.82	.92	1.08	1.29	(1.40)		1.09	.92	(.72)	
Departures		+.03	+.02	+.03	+.06	−.11		+.05	+.01	−.07	
Madison, Wis.											
Dec. 9	0.81			1.18							0.81
Dec. 14	1.68							1.30			1.24
Dec. 15	.48			1.20				1.16			.64
Dec. 16	.43							1.21			.74
Dec. 21	3.99							1.00			3.99
Dec. 28	2.87		.74	.98				1.16			2.49
Means			(.74)	1.12				1.17			
Departures			−.35	−.09				−.06			
Lincoln, Nebr.											
Dec. 3	3.63	.56	.72								5.16
Dec. 7	.96		1.22	1.34							.91
Dec 13	.86	.84	1.00	1.21			1.30	1.10	.91		1.32
Dec. 15	.58	1.04	1.25	1.38							.64
Dec. 17	1.19	.98	1.15	1.31	1.45		1.38				1.78
Dec. 21	2.87	.87	.98	1.16			1.24				3.15
Means		.86	1.05	1.28	(1.45)		1.31	(1.10)	(.91)		
Departures		−.07	−.01	+.06	+.06		+.02	−.03	−.10		

* Extrapolated.

TABLE 2.—*Average daily totals of solar radiation (direct+diffuse) received on a horizontal surface*

Week beginning—	Washington	Madison	Lincoln	Chicago	New York	Fresno	Pittsburgh	Fairbanks	Twin Falls	La Jolla	Gainesville	Miami	New Orleans
	Gram calories per square centimeter												
1932	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*
Dec. 3	230	93	187	62	160	237	78	6	167	195	180	279	155
Dec. 10	87	148	198	128	89	208	72	10	211	159	86	257	88
Dec. 17	171	127	188	118	124	94	97	8	122	203	63	272	118
Dec. 24	100	108	174	132	104	134	67	5	152	232	110	290	104
	Departures from weekly normals												
Dec. 3	+78	−26	+21	−13	+63	+51	−4		+21	−73	−10	−43	
Dec. 10	−49	+34	+39	+52	−3	+36	±0		+75	−81	−30	−33	
Dec. 17	+29	+6	+17	+36	+28	−62	+24		−21	−22	+27	−4	
Dec. 24	−39	−16	−1	+49	+3	−14	−15		+2	+4	+19	+7	
	Accumulated departures at end of year												
	+9,782	+364	+2,055	+18,496	+21,411	+10,442	+6,432		−8,866	−5,637		−7,317	
	Percentage departures at end of year												
	+8.0	+0.3	+1.5	+19.7	+21.9	+6.5	+6.2		−6.0	−4.4		−4.5	

TABLE 3.—*Solar radiation measurements, and determinations of atmospheric turbidity factor, β, Washington, D. C., December, 1932*

Date and solar hour angle	Solar altitude, h.	Air mass, m.	I_m	I_y	I_r	β	Blueness of sky	Atmospheric dust particles per cubic centimeter	Notes: Skylight polarization, P. clouds, etc.
1933 Dec. 20			gr. cal.	gr. cal.	gr. cal.				
3:11 a	13–18	4.28	0.870	0.654	*0.585*	0.050		668	
3:06 a	13–58	4.10	.903	*.660*	.589	.045			
2:43 a	16–52	3.41	.972	*.773*	.636	.055			
2:39 a	17–24	3.31	.992	.779	*.640*	.055			
2:27 a	18–47	3.08	1.032	*.795*	.657	.055			
2:23 a	19–17	3.00	1.040	*.798*	.658	.055			
1:18 a	25–04	2.35	1.187	.880	*.710*	.045			
1:13 a	25–23	2.33	1.196	.883	*.713*	.040			
0:30 a	27–19	2.17	1.228	*.895*	.704	.035			
0:26 a	27–23	2.17	1.241	.898	*.707*	.030	6		P=63.2.
Dec. 22									
3:13 a	13–00	4.37	1.002	.785	*.657*	.030		*1,090	
3:09 a	13–32	4.22	1.028	*.788*	.660	.030			
2:32 a	18–10	3.18	1.170	*.878*	.712	.025			
2:25 a	18–58	3.06	1.185	.883	*.715*	.025			
0:50 a	26–54	2.22	1.311	.935	*.752*	.020			
0:46 a	26–53	2.20	1.328	*.936*	.505	.020	7		P=63.0.
Dec. 29									
3:03 a	14–33	3.93	.838	.643	*.553*	.060		863	
2:57 a	15–18	3.74	.861	*.648*	.556	.060			
1:11 a	25–54	2.28	.959	*.747*	*.620*	.105			
1:05 a	26–07	2.27	.987	.752	*.624*	.095			
0:24 a	27–38	2.15	1.138	*.826*	.669	.055			
0:19 a	27–43	2.14	1.155	.829	*.672*	.050	4		P=52.4.

*Local smoke.

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, Superintendent United States Naval Observatory. Data furnished by Naval Observatory, in cooperation with Harvard, Perkins, and Mount Wilson Observatories. The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column]

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longitude	Latitude	Spot	Group	
1932	h. m.	°	°	°			
Dec. 1 (Naval Observatory)	11 31	−46.0	69.0	+5.0		216	216
Dec. 2 (Naval Observatory)	13 21	−31.0	69.8	+5.0		123	123
Dec. 3 (Naval Observatory)	10 54	−20.0	68.9	+5.0		93	93
Dec. 4 (Naval Observatory)	12 47	No spots.					
Dec. 5 (Naval Observatory)	11 40	No spots.					
Dec. 6 (Naval Observatory)	11 5	−83.0	326.3	+10.0	370		370
Dec. 7 (Naval Observatory)	10 41	−71.0	325.4	+10.0	370		370
Dec. 8 (Naval Observatory)	11 40	−57.0	325.6	+10.0	370		370
Dec. 9 (Naval Observatory)	10 14	−43.0	327.3	+10.0	432		432
Dec. 10 (Mount Wilson)	12 0	−29.0	327.1	+10.5	609		609
Dec. 12 (Perkins Observatory)	12 35	+2.0	331.5	+10.0		90	90
Dec. 13 (Mount Wilson)	14 15	−9.0	306.4	+11.0		10	
		+12.0	327.4	+10.0	506		516
Dec. 15 (Naval Observatory)	10 50	+37.0	327.9	+10.0		293	293
Dec. 16 (Naval Observatory)	11 25	+51.0	328.4	+10.0		401	401
Dec. 17 (Mount Wilson)	13 50	+56.0	319.0	+9.0	6		
		+66.0	329.0	+10.0		440	446
Dec. 18 (Naval Observatory)	13 13	+67.0	317.0	+9.0		123	
		+80.0	330.0	+10.0		370	493
Dec. 19 (Perkins Observatory)	13 35	+72.0	308.6	+10.5		90	90
Dec. 20 (Naval Observatory)	10 46	+86.0	311.0	+12.0		309	309
Dec. 21 (Mount Wilson)	12 15	+89.0	300.0	+12.0		103	103
Dec. 22 (Naval Observatory)	10 53	No spots					
Dec. 23 (Naval Observatory)	11 1	No spots.					
Dec. 24 (Perkins Observatory)	14 50	No spots.					
Dec. 25 (Perkins Observatory)	15 0	No spots.					
Dec. 26 (Perkins Observatory)	14 10	No spots.					
Dec. 27 (Mount Wilson)	12 25	+20.0	151.9	+8.0		49	49
Dec. 28 (Perkins Observatory)	16 20	No spots					
Dec. 29 (Naval Observatory)	11 17	+50.0	156.2	+8.0	31		31
Dec. 30 (Mount Wilson)	12 15	+62.0	154.5	+6.0		50	50
Mean daily area for December							195

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR DECEMBER, 1932

(Dependent alone on observations at Zurich and its station at Arosa)

[Data furnished through the courtesy of Prof. W. Brunner, University of Zurich, Switzerland]

December, 1932	Relative numbers	December, 1932	Relative numbers	December, 1932	Relative numbers	December, 1932	Relative numbers	December, 1932	Relative numbers	December, 1932	Relative numbers
1		6	*d* 8	11	15	16	13	21	0	26	0
2	13	7	10	12	*b* 22	17	18	22	0	27	*Mc* 10
3	13	8	11	13	23	18	20	23	0	28	10
4	10	9	13	14	16	19	19	24	0	29	9
5	8	10	13	15	15	20	16	25	0	30	9
										31	8

Mean: 30 days=10.7.

a=Passage of an average-sized group through the central meridian.
b=Passage of a large group or spot through the central meridian.
c=New formation of a center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central zone.
d=Entrance of a large or average sized center of activity on the east limb.

AEROLOGICAL OBSERVATIONS

[Aerological Division, W. R. Gregg, in charge]

By L. T. SAMUELS

Free-air temperatures during December were above normal over the Lake region and southern stations and below normal over the western and northern stations. (Table 1.) The largest positive departures occurred over Atlanta and the largest negative departures over Ellendale.

The mean free-air relative humidities were above normal except at Omaha where the negative departures increased with elevation. The largest positive departures occurred at the southern stations.

Free-air resultant wind directions in the lower levels were close to normal except in the southeastern states where the resultants showed pronounced southerly components. At the higher levels the resultant directions were close to normal except on the Pacific coast where they showed pronounced northerly components. Resultant velocities in most cases were greater than normal at all levels.